REMARKS

The Office Action mailed August 26, 2009, has been received and reviewed. Claims 1, 3 through 22, 24 through 27, 31 through 40, 42 and 43 are currently pending in the application. Claims 1, 3 through 22, 24 through 27, 31 through 40, 42 and 43 stand rejected. Applicants have amended claims 1, 5-14, 17-19, 21, 24-26, 31-36, 38, 39, 42 and 43. Each of claims 1, 5-14, 17-19, 21, 24-26, 31-36, 38, 39, 42 and 43 have been amended to replace the word "layer" with "material" and/or to remove the word "layer." Support for additional amendments to claims 1, 7, 14, 18, 24-26, 31, 35, 38, 42 and 43 may be found throughout the as-filed specification including, for example, page 16, lines 3-7. Support for additional amendments to claim 12 may be found throughout the as-filed specification for example, page 14, lines 14-22 and FIG. 7A/7B. Reconsideration is respectfully requested.

Drawing Objection

The drawings are objected to under 37 CFR §1.83(a). The Examiner asserts that the drawings do not show the elements of claim 12 of "etching to form a second upper surface comprises etching using an etch recipe that etch the conformal layer faster than the first dielectric layer." Applicants respectfully traverse this rejection, as hereinafter set forth. Claim 12 has been amended to recite "The method according to Claim 7, wherein removing portions of the conformal material that overlie the remaining portions of the oxide further comprises etching using an etch recipe that etches the conformal material faster than the first dielectric material by a ratio in a range of from about 1:1 to about 2:1." Support for the amendment may be found throughout the as-filed specification for example, page 14, lines 14-22 and FIG. 7A/7B. Reconsideration and withdrawal of the rejection is requested.

35 U.S.C. § 112 Claim Rejections

Claims 12 and 13 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had

possession of the claimed invention. Applicants respectfully traverse this rejection, as hereinafter set forth.

Claims 12 and 13 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicants respectfully traverse this rejection, as hereinafter set forth. Claim 12 has been amended to recite "The method according to Claim 7, wherein removing portions of the conformal material that overlie the remaining portions of the oxide further comprises etching using an etch recipe that etches the conformal material faster than the first dielectric material by a ratio in a range of from about 1:1 to about 2:1." Support for the amendment may be found throughout the as-filed specification for example, page 14, lines 14-22. Reconsideration and withdrawal of the rejection is requested.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 6,097,072 to Omid-Zohoor in View of U.S. Patent No. 5,387,540 to Poon et al.

Claims 1, 3 through 9, 11 through 22, 24 through 26, 31 through 40, 42 and 43 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Omid-Zohoor (U.S. Patent No. 6,097,072) in view of Poon et al. (U.S. Patent No. 5,387,540). Applicants respectfully traverse this rejection, as hereinafter set forth.

To establish a *prima facie* case of obviousness the prior art reference (or references when combined) **must teach or suggest all the claim limitations**. *In re Royka*, 490 F.2d 981, 985 (CCPA 1974); *see also* MPEP § 2143.03. Additionally, the Examiner must determine whether there is "an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740-1741, 167 L.Ed.2d 705, 75 USLW 4289, 82 U.S.P.Q.2d 1385 (2007). Further, rejections on obviousness grounds "cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *Id* at 1741, quoting *In re Kahn*, 441, F.3d 977, 988 (Fed. Cir. 2006). To establish a *prima facie* case of obviousness there must be a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097

(Fed. Cir. 1986). Furthermore, the reason that would have prompted the combination and the reasonable expectation of success must be found in the prior art, common knowledge, or the nature of the problem itself, and not based on the Applicant's disclosure. *DyStar Textilfarben GmbH & Co. Deutschland KG v. C. H. Patrick Co.*, 464 F.3d 1356, 1367 (Fed. Cir. 2006); MPEP § 2144. Underlying the obvious determination is the fact that statutorily prohibited hindsight cannot be used. *KSR*, 127 S.Ct. at 1742; *DyStar*, 464 F.3d at 1367.

Omid-Zohoor discloses a method of forming trenches with suppressed parasitic edge transistors. Trenches 360 are formed in a substrate 120 having a pad oxide layer 340 and silicon nitride layer 344 thereon. (Omid-Zohoor, FIG. 3I). Spacers 356 may flank the trenches 360. A thick oxide layer 364 is deposited to cover the wafer and fill the trenches 360. A reverse mask 368 is placed over defined trench regions. The mask is followed by an etch which creates oxide ridges. (Omid-Zohoor, col. 4, lines 47-55, FIG. 3L). The upper surface of the oxide layer 372 is polished to expose the silicon nitride layer 344. (*Id.*, FIG. 3M). The silicon nitride layer 344 is removed, but the pad oxide layer 340 remains. (*Id.* at col. 5, lines 2-4). Portions of the overfilled oxide 376 and pad oxide 344 are removed together resulting in slight oxide humps above the trenches. (*Id.*, FIG. 3N).

Poon is cited for teaching the formation of a liner along the sidewall of a trench. (Office Action mailed February 20, 2009, page 5).

The proposed combination of Omid-Zohoor and Poon fails to teach or suggest "implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide" or "removing the first dielectric material and portions of the oxide underlying the first dielectric material such that the conformal material fills each said isolation trench, ~~and~~ extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal material start on an upper surface of the semiconductor substrate and are substantially orthogonal to the upper surface contour of the conformal material" as recited in independent claim 1. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide."

Poon, col. 2, lines 59-64.

The proposed combination of references does not teach or suggest "removing the first dielectric material and portions of the oxide underlying the first dielectric material such that the conformal material fills each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal material start on an upper surface of the semiconductor substrate and are substantially orthogonal to the upper surface contour of the conformal material" as recited in independent claim 1. Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 and portions of the overfilled oxide 376 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal material start on an upper surface of the semiconductor substrate and are substantially orthogonal to the upper surface contour of the conformal material" as recited in claim 1 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed. Specifically, Omid-Zohoor states:

> As shown in FIG. 3N, when the silicon nitride is removed by etch, the pad oxide serves as an etch stop and the overfilled oxide 376 remains.
> Next, in FIG. 3O, the pad oxide in the active region is etched such that it is substantially removed from the surface of the substrate 120. However, in the area of the trenches 360, oxide humps 376 remain with a top level above the surface of the substrate 120. Portions of the oxide humps 376 cover the edges and corner of the trenches 360.

(Omid-Zohoor, col. 5, lines 2-10). Omid-Zohoor fails to teach or suggest that the upper surface contour of the overfilled oxide 376 is substantially orthogonal to the sidewalls of the overfilled oxide 376 as recited in claim 1 of the presently claimed invention. Poon fails to cure the deficiencies of Omid-Zohoor. Instead, Poon teaches that trench plug 34 has substantially vertical sidewalls. (Poon, FIG. 6). As the proposed combination of references fails to teach or suggest each and every limitation of independent claim 1, Omid-Zohoor in view of Poon cannot render

claim 1 obvious. Accordingly, claim 1 is allowable.

Claims 3-6 are each allowable as depending from allowable claim 1.

With respect to independent claim 7, the proposed combination of Omid-Zohoor and Poon fails to teach or suggest "implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," or "removing the first dielectric material and portions of the oxide underlying the first dielectric material such that the conformal material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the conformal material begin on an upper surface of the semiconductor substrate and are oriented substantially orthogonal to the upper surface contour of the conformal material" as recited in claim 7 of the presently claimed invention. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 and portions of the overfilled oxide 376 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal material begin on an upper surface of the semiconductor substrate and are oriented substantially orthogonal to the upper surface contour of the conformal material" as recited in claim 7 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon fails to cure the deficiencies of Omid-Zohoor. Instead, Poon teaches that trench plug 34 has substantially vertical sidewalls. (Poon, FIG. 6). As the proposed combination of references fails to teach or suggest each and every limitation of claim 7, Omid-Zohoor in view of

Poon cannot render claim 7 obvious. Accordingly, independent claim 14, and dependent claims 8, 9, 11 and 12 therefrom, are allowable.

With respect to independent claim 14, the proposed combination of Omid-Zohoor and Poon fails to teach or suggest "implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," or "removing the silicon nitride and portions of the oxide underlying the silicon nitride such that the conformal second silicon dioxide material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the second silicon dioxide material start on an upper surface of the semiconductor substrate and lie substantially orthogonal to the upper surface contour of the second silicon dioxide material" as recited in claim 14 of the presently claimed invention. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 and portions of the overfilled oxide 376 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the second silicon dioxide material start on an upper surface of the semiconductor substrate and lie substantially orthogonal to the upper surface contour of the second silicon dioxide material" as recited in claim 14 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon fails to cure the deficiencies of Omid-Zohoor. Instead, Poon teaches that trench plug 34 has substantially vertical sidewalls. (Poon, FIG. 6). As the proposed combination of references fails to teach or suggest each and every limitation of claim 14, Omid-Zohoor in view

of Poon cannot render claim 14 obvious. Accordingly, independent claim 14, and dependent claims 15-17 therefrom, are allowable.

With respect to independent claim 18, the proposed combination of Omid-Zohoor and Poon fails to teach or suggest "implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," "removing the first dielectric material, polysilicon and portions of the oxide underlying the first dielectric material such that the conformal third material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the conformal third material extend from an upper surface of the semiconductor substrate to the upper surface contour of the third conformal material and are substantially orthogonal to the upper surface contour of the conformal third material" or "wherein the microelectronic structure is defined at least in part by the plurality of spacers, the conformal third material, and the plurality of isolation trenches" as recited in independent claim 18. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal third material extend from an upper surface of the semiconductor substrate to the upper surface contour of the third conformal material and are substantially orthogonal to the upper surface contour of the conformal third material" as recited in claim 18 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon fails to cure the deficiencies of Omid-Zohoor. Instead, Poon teaches that trench plug 34 has substantially vertical sidewalls. (Poon, FIG. 6). As Omid-Zohoor in view of Poon fails to teach or suggest this limitation, the proposed combination of art likewise fails to teach or suggest that "the microelectronic structure is defined at least in part by the plurality of spacers, the conformal third material, and the plurality of isolation trenches" as recited in claim 18.

As the proposed combination of references fails to teach or suggest each and every limitation of independent claim 18, Omid-Zohoor in view of Poon cannot render claim 18 obvious. Accordingly, claim 18 is allowable.

Claims 19-22 are each allowable, at least, as depending from allowable claim 18.

With respect to independent claim 24, the proposed combination of Omid-Zohoor and Poon fails to teach or suggest "implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," "removing the first dielectric material, polysilicon and portions of the oxide underlying the first dielectric material such that the conformal third material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the conformal third material extend from an upper surface of the semiconductor substrate to the upper surface contour of the conformal third material and the sidewalls are oriented substantially orthogonal to the upper surface contour of the conformal third material" or "wherein the microelectronic structure is defined at least in part by the plurality of spacers, the conformal third material, and the plurality of isolation trenches" as recited in independent claim 24. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from

each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal third material extend from an upper surface of the semiconductor substrate to the upper surface contour of the conformal third material and the sidewalls are oriented substantially orthogonal to the upper surface contour of the conformal third material" as recited in claim 24 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon fails to cure the deficiencies of Omid-Zohoor. Instead, Poon teaches that trench plug 34 has substantially vertical sidewalls. (Poon, FIG. 6). As Omid-Zohoor in view of Poon fails to teach or suggest this limitation, the proposed combination of art likewise fails to teach or suggest that "the microelectronic structure is defined at least in part by the plurality of spacers, the conformal third material, and the plurality of isolation trenches" as recited in claim 24.

As the proposed combination of references fails to teach or suggest each and every limitation of independent claim 24, Omid-Zohoor in view of Poon cannot render claim 24 obvious. Accordingly, claim 24 is allowable.

With respect to independent claim 25, the proposed combination of Omid-Zohoor and Poon fails to teach or suggest "implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," or "removing the first dielectric material, first polysilicon material and portions of the oxide underlying the first dielectric material such that the conformal third material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the conformal third material originate on an upper surface of the semiconductor substrate and extend to the upper surface contour of the conformal third material, the sidewalls lie substantially orthogonal to the upper surface contour of the conformal third material" as recited in claim 25 of the presently claimed invention. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at pp. 7). Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal third material originate on an upper surface of the semiconductor substrate and extend to the upper surface contour of the conformal third material, the sidewalls lie substantially orthogonal to the upper surface contour of the conformal third material" as recited in claim 25 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon fails to cure the deficiencies of Omid-Zohoor. Instead, Poon teaches that trench plug 34 has substantially vertical sidewalls. (Poon, FIG. 6). As the proposed combination of references fails to teach or suggest each and every limitation of claim 25, Omid-Zohoor in view of Poon cannot render claim 25 obvious. Accordingly, claim 25 is allowable.

With respect to independent claim 26, the proposed combination of Omid-Zohoor and Poon fails to teach or suggest "implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," "heat treating the oxide, spacers and conformal third material to fuse the oxide, spacers and conformal third material" "removing the first dielectric material, polysilicon and portions of the oxide underlying the first dielectric material such that the conformal third material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the conformal third material originate on an upper surface of the semiconductor substrate to the upper surface contour of the conformal third material and the sidewalls are substantially orthogonal to the upper surface contour of the conformal third material" or "wherein the microelectronic structure is defined at least in part by the plurality of spacers, the conformal third material, and the plurality of isolation trenches as recited in claim 26. The Examiner acknowledges that Omid-

Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p 7). Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal third material originate on an upper surface of the semiconductor substrate to the upper surface contour of the conformal third material and the sidewalls are substantially orthogonal to the upper surface contour of the conformal third material" as recited in claim 26 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon fails to cure the deficiencies of Omid-Zohoor. Instead, Poon teaches that trench plug 34 has substantially vertical sidewalls. (Poon, FIG. 6). As Omid-Zohoor in view of Poon fails to teach or suggest this limitation, the proposed combination of art likewise fails to teach or suggest that "the microelectronic structure is defined at least in part by the plurality of spacers, the conformal third material, and the plurality of isolation trenches" as recited in claim 26.

Further, the Examiner does not identify any portion of Omid-Zohoor or Poon that teaches or suggests "heat treating the oxide, spacers and conformal third material to fuse the oxide, spacers and conformal third material" as recited in claim 26.

As the proposed combination of references fails to teach or suggest each and every limitation of claim 26, Omid-Zohoor in view of Poon cannot render claim 26 obvious. Accordingly, claim 26 is allowable.

With respect to independent claim 31, the proposed combination of Omid-Zohoor and

Poon fails to teach or suggest "forming a corresponding doped region below the termination of each isolation trench with a semiconductor substrate by implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," "heat treating the oxide, liner, spacers and conformal second material to fuse the oxide, liner spacers and conformal second material" or "removing the silicon nitride, first polysilicon material and portions of the oxide underlying the silicon nitride such that the conformal second material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the conformal second material originate on an upper surface of the semiconductor substrate and continue to the upper surface contour of the conformal second material and the sidewalls lie substantially orthogonal to the upper surface contour of the conformal second material" as recited in claim 31. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal second material originate on an upper surface of the semiconductor substrate and continue to the upper surface contour of the conformal second material and the sidewalls lie substantially orthogonal to the upper surface contour of the conformal second material" as recited in claim 31 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon fails to cure the deficiencies of Omid-Zohoor. Instead, Poon teaches that trench plug 34 has substantially vertical sidewalls. (Poon, FIG. 6). Further, the Examiner does not identify

any portion of Omid-Zohoor or Poon that teaches or suggests "heat treating the oxide, liner, spacers and conformal second material to fuse the oxide, liner spacers and conformal second material" as recited in claim 31.

As the proposed combination of references fails to teach or suggest each and every limitation of claim 31, Omid-Zohoor in view of Poon cannot render claim 31 obvious. Accordingly, claim 31 is allowable.

Claims 32-34 are each allowable, at least, as depending from allowable claim 31.

With respect to independent claim 35, the proposed combination of Omid-Zohoor and Poon fails to teach or suggest "implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," "removing the first dielectric material, polysilicon and portions of the oxide underlying the first dielectric material such that the conformal third material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the second material initiate on an upper surface of the semiconductor substrate and end at the upper surface contour of the second material, the sidewalls are substantially orthogonal to the upper surface contour of the second material" or "wherein the microelectronic structure is defined at least in part by the plurality of spacers, the conformal third material, and the plurality of isolation trenches" as recited in independent claims 18, 24 and 35. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the second material initiate on an upper surface of the semiconductor substrate and end at the upper surface

contour of the second material, the sidewalls are substantially orthogonal to the upper surface contour of the second material" as recited in claim 35 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon fails to cure the deficiencies of Omid-Zohoor. Instead, Poon teaches that trench plug 34 has substantially vertical sidewalls. (Poon, FIG. 6). As Omid-Zohoor in view of Poon fails to teach or suggest this limitation, the proposed combination of art likewise fails to teach or suggest that "the microelectronic structure is defined at least in part by the plurality of spacers, the second material, and the plurality of isolation trenches" as recited in claim 35.

As the proposed combination of references fails to teach or suggest each and every limitation of independent claim 35, Omid-Zohoor in view of Poon cannot render claim 35 obvious. Accordingly, claim 35 is allowable. Claims 36 and 37 are each allowable as depending from allowable claim 35.

Claim 36 is further allowable as the proposed combination of Omid-Zohoor and Poon fails to teach or suggest "doping the semiconductor substrate with dopant having a first conductivity type; and wherein implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide further comprises; doping the semiconductor substrate below each isolation trench with a dopant having a second conductivity type opposite the first conductivity type to form a doped trench bottom that is below and in contact with a respective one of the isolation trenches" as recited in claim 36. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p 7). Poon lacks any teaching or suggestion that ions are dopants of two different conductivities may be used. Poon, col. 2, lines 59-64. As the proposed combination of references fails to teach or suggest each and every limitation of claim 36, Omid-Zohoor in view of Poon cannot render claim 36 obvious. Accordingly, claim 36 is allowable.

Claim 37 is further allowable as the proposed combination of Omid-Zohoor and Poon fails to teach or suggest that "the doped trench bottom has a width; each isolation trench has a width and the width of each doped trench bottom is greater than the width of the respective

isolation trench" as recited in claim 37. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Poon lacks any teaching or suggestion of the respective width of the trench compared to the trench bottom. As the proposed combination of references fails to teach or suggest each and every limitation of claim 37, Omid-Zohoor in view of Poon cannot render claim 37 obvious. Accordingly, claim 37 is allowable.

With respect to independent claim 38, the proposed combination of Omid-Zohoor and Poon fails to teach or suggest "implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," or "removing the first material and portions of the oxide underlying the first material such that the second material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the second material commence at an upper surface of the semiconductor substrate and end at the upper surface contour of the second material and the sidewalls are oriented substantially orthogonal to the upper surface contour of the second material, wherein the microelectronic structure is defined at least in part by the plurality of spacers, the second material and the plurality of isolation trenches" as recited in claim 38. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the second material commence at an upper surface of the semiconductor substrate and end at the upper surface contour of the second material and the sidewalls are oriented substantially orthogonal to the upper surface contour of the second material" as recited in claim 38 because in Omid-Zohoor,

the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon fails to cure the deficiencies of Omid-Zohoor. Instead, Poon teaches that trench plug 34 has substantially vertical sidewalls. (Poon, FIG. 6). As Omid-Zohoor in view of Poon, fails to teach or suggest this limitation, the proposed combination of art likewise fails to teach or suggest that "the microelectronic structure is defined at least in part by the plurality of spacers, the second material, and the plurality of isolation trenches" as recited in claim 38.

As the proposed combination of references fails to teach or suggest each and every limitation of claim 38, Omid-Zohoor in view of Poon cannot render claim 38 obvious. Accordingly, claim 38 is allowable.

In addition to the reasons submitted with respect to independent claim 38, the proposed combination of Omid-Zohoor and Poon fails to teach or suggest "doping the semiconductor substrate with dopant having a first conductivity type; and wherein implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide further comprises; doping the semiconductor substrate below each isolation trench with a dopant having a second conductivity type opposite the first conductivity type to form a doped trench bottom that is below and in contact with a respective one of the isolation trenches" as recited in claim 39. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p 7). Poon lacks any teaching or suggestion that ions are dopants of two different conductivities may be used. Poon, col. 2, lines 59-64.

As the proposed combination of references fails to teach or suggest each and every limitation of claim 39, Omid-Zohoor in view of Poon cannot render claim 39 obvious. Accordingly, claim 39 is allowable.

In addition to the reasons submitted with respect to claims 38 and 39, the proposed combination of Omid-Zohoor and Poon fails to teach or suggest that "the doped trench bottom has a width; each isolation trench has a width and the width of each doped trench bottom is

greater than the width of the respective isolation trench" as recited in claim 40. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Poon lacks any teaching or suggestion of the respective width of the trench compared to the trench bottom.

As the proposed combination of references fails to teach or suggest each and every limitation of claim 40, Omid-Zohoor in view of Poon cannot render claim 40 obvious. Accordingly, claim 40 is allowable.

With respect to independent claim 42, the proposed combination of Omid-Zohoor and Poon fails to teach or suggest "doping the first isolation trench and second isolation trench by implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," "heat treating the oxide, first spacer, second spacer and conformal second material of the first isolation structure to fuse the oxide, first spacer, second spacer and conformal second material of the first isolation structure," "heat treating the oxide, first spacer, second spacer and conformal second material of the second isolation structure to fuse the oxide, first spacer, second spacer and conformal second material of the second isolation structure" or "removing the first material and portions of the oxide underlying the first material such that the second material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the second material initiate on an upper surface of the semiconductor substrate and extend toward the upper surface contour of the second material, the sidewalls are oriented substantially orthogonal to the upper surface contour of the second material wherein the microelectronic structure is defined at least in part by the active area, the second material and the first and second isolation trenches" as recited in claim 42. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in

slight oxide humps above the trenches. (*Id.,* col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the second material initiate on an upper surface of the semiconductor substrate and extend toward the upper surface contour of the second material, the sidewalls are oriented substantially orthogonal to the upper surface contour of the second material" as recited in claim 42 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon fails to cure the deficiencies of Omid-Zohoor. Instead, Poon teaches that trench plug 34 has substantially vertical sidewalls. (Poon, FIG. 6). As Omid-Zohoor in view of Poon fails to teach or suggest this limitation, the proposed combination of art likewise fails to teach or suggest that "the microelectronic structure is defined at least in part by the active area, the second material, and the first and second isolation trenches" as recited in claim 42.

Further, the Examiner does not identify any portion of Omid-Zohoor or Poon that teaches or suggests "heat treating the oxide, first spacer, second spacer and conformal second material of the first isolation structure to fuse the oxide, first spacer, second spacer and conformal second material of the first isolation structure," or "heat treating the oxide, first spacer, second spacer and conformal second material of the second isolation structure to fuse the oxide, first spacer, second spacer and conformal second material of the second isolation structure" as recited in claim 42.

As the proposed combination of references fails to teach or suggest each and every limitation of claim 42, Omid-Zohoor in view of Poon cannot render claim 42 obvious. Accordingly, claim 42 is allowable.

With respect to independent claim 43, the proposed combination of Omid-Zohoor and Poon fails to teach or suggest "doping the first isolation trench and second isolation trench by implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," "heat treating the oxide, first spacer, second spacer and conformal second

material of the first isolation structure to fuse the oxide, first spacer, second spacer and conformal second material of the first isolation structure," "heat treating the oxide, first spacer, second spacer and conformal second material of the second isolation structure to fuse the oxide, first spacer, second spacer and conformal second material of the second isolation structure" or "removing the first material and portions of the oxide underlying the first material such that the second material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the conformal second material originate on an upper surface of the semiconductor substrate and extend toward the upper surface contour of the second material, the sidewalls are oriented substantially orthogonal to the upper surface contour of the second material" as recited in claim 43. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal second material originate on an upper surface of the semiconductor substrate and extend toward the upper surface contour of the second material, the sidewalls are oriented substantially orthogonal to the upper surface contour of the second material" as recited in claim 43 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon fails to cure the deficiencies of Omid-Zohoor. Instead, Poon teaches that trench plug 34 has substantially vertical sidewalls. (Poon, FIG. 6). Further, the Examiner does not identify any portion of Omid-Zohoor or Poon that teaches or suggests "heat treating the oxide, first

spacer, second spacer and conformal second material of the first isolation structure to fuse the oxide, first spacer, second spacer and conformal second material of the first isolation structure," or "heat treating the oxide, first spacer, second spacer and conformal second material of the second isolation structure to fuse the oxide, first spacer, second spacer and conformal second material of the second isolation structure" as recited in claim 43.

As the proposed combination of references fails to teach or suggest each and every limitation of claim 43, Omid-Zohoor in view of Poon cannot render claim 43 obvious. Accordingly, claim 43 is allowable.

Obviousness Rejection Based on U.S. Patent No. 6,097,072 to Omid-Zohoor in View of U.S. Patent No. 5,387,540 to Poon et al., U.S. Patent No. 5,858,858 to Park et al. and U.S. Patent No. 6,069,083 to Miyashita et al.

Claims 26 and 27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Omid-Zohoor (U.S. Patent No. 6,097,072) in view of Poon et al. (U.S. Patent No. 5,387,540), Park et al. (U.S. Patent 5,858,858) and Miyashita et al. (U.S. Patent No. 6,069,083). Applicants respectfully traverse this rejection, as hereinafter set forth.

The discussion of Omid-Zohoor and Poon above is incorporated herein. Park is cited for teaching the formation of a trench and for heat treatment to densify the conformal layer. (Office Action sent August 26, 2009, page 28). Miyashita *et al.* teaches methods of CMP and is cited for teaching a planarization process which etches the conformal layer and spacers faster than the first dielectric layer by a ratio of from about 1:1 to about 2:1. (Office Action sent August 26, 2009, page 29).

The proposed combination of Omid-Zohoor and Poon, Park and Miyashita fails to teach or suggest "implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," "removing the first dielectric material, polysilicon and portions of the oxide underlying the first dielectric material such that the conformal third material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the conformal third material originate on an upper surface of the semiconductor substrate to the upper surface contour of the conformal third material, the

sidewalls are substantially orthogonal to the upper surface contour of the conformal third material" or "wherein the microelectronic structure is defined at least in part by the plurality of spacers, the conformal third material, and the plurality of isolation trenches as recited in claim 26. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 27). Park also fails to teach or suggest ion implantation. Poon and Miyashita fail to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." *See* Poon, col. 2, lines 59-64; Miyashita, col. 1, lines 24-34.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal third material originate on an upper surface of the semiconductor substrate to the upper surface contour of the conformal third material, the sidewalls are substantially orthogonal to the upper surface contour of the conformal third material" as recited in claim 26 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon, Park and Miyashita fail to cure the deficiencies of Omid-Zohoor. Instead, Park and Poon teaches that trench plug (24A)(34) has substantially vertical sidewalls and does not extends horizontally away from the isolation trench. (Poon, FIG. 6; Park FIGs. 7 and 8). Similarly, Miyashita fails to teach or suggest this limitation. (Miyashita, FIGs. 5M, 6D). As Omid-Zohoor in view of Poon, Park and Miyashita fails to teach or suggest this limitation, the proposed combination of art likewise fails to teach or suggest that "the microelectronic structure is defined at least in part by the plurality of spacers, the conformal third material, and the plurality of isolation trenches."

As the proposed combination of references fails to teach or suggest each and every limitation of claim 26, Omid-Zohoor in view of Poon, Park and Miyashita cannot render claim 26 obvious. Accordingly, independent claim 26 and dependent claim 27 therefrom are allowable.

Obviousness Rejection Based on U.S. Patent No. 6,097,072 to Omid-Zohoor in View of U.S. Patent No. 5,387,540 to Poon et al. and U.S. Patent No. 5,858,858 to Park et al.

Claims 31 through 34, 42 and 43 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Omid-Zohoor (U.S. Patent No. 6,097,072) in view of Poon et al. (U.S. Patent No. 5,387,540) and Park et al. (U.S. Patent No. 5,858,858). Applicants respectfully traverse this rejection, as hereinafter set forth.

The discussion of Omid-Zohoor, Poon and Park above is incorporated herein. The proposed combination of Omid-Zohoor in view of Poon and Park fails to teach or suggest "forming a corresponding doped region below the termination of each isolation trench with a semiconductor substrate by implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," or "removing the silicon nitride, first polysilicon material and portions of the oxide underlying the silicon nitride such that the conformal second material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the conformal second material originate on an upper surface of the semiconductor substrate and continue to the upper surface contour of the conformal second material and the sidewalls lie substantially orthogonal to the upper surface contour of the conformal second material" as recited in claim 31. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 31). Park also fails to teach or suggest ion implantation. Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in

slight oxide humps above the trenches. (*Id.,* col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal second material originate on an upper surface of the semiconductor substrate and continue to the upper surface contour of the conformal second material and the sidewalls lie substantially orthogonal to the upper surface contour of the conformal second material" as recited in claim 31 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon and Park fail to cure the deficiencies of Omid-Zohoor. Instead, Poon and Park teach that trench plug (24a) 34 has substantially vertical sidewalls and does not extends horizontally away from the isolation trench. (Poon, FIG. 6; Park FIGs. 7 and 8).

As the proposed combination of references fails to teach or suggest each and every limitation of claim 31, Omid-Zohoor in view of Poon and Park cannot render claim 31 obvious. Accordingly, independent claim 31 and dependent claims 32-34 therefrom are allowable.

With respect to independent claim 42, the proposed combination of Omid-Zohoor, Poon and Park fails to teach or suggest "doping the first isolation trench and second isolation trench by implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," "heat treating the oxide, first spacer, second spacer and conformal second material of the first isolation structure to fuse the oxide, first spacer, second spacer and conformal second material of the first isolation structure," "heat treating the oxide, first spacer, second spacer and conformal second material of the second isolation structure to fuse the oxide, first spacer, second spacer and conformal second material of the second isolation structure" or "removing the first material and portions of the oxide underlying the first material such that the second material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the second material initiate on an upper surface of the semiconductor substrate and extend toward the upper surface contour of the second material, the sidewalls are oriented substantially orthogonal to the upper surface contour of the

second material wherein the microelectronic structure is defined at least in part by the active area, the second material and the first and second isolation trenches" as recited in claim 42. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 27). Park also fails to teach or suggest ion implantation. Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the second material initiate on an upper surface of the semiconductor substrate and extend toward the upper surface contour of the second material, the sidewalls are oriented substantially orthogonal to the upper surface contour of the second material" as recited in claim 42 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon and Park fail to cure the deficiencies of Omid-Zohoor. Instead, Poon and Park teach that trench plug (24a) 34 has substantially vertical sidewalls and does not extends horizontally away from the isolation trench. (Poon, FIG. 6; Park FIGs. 7 and 8). As Omid-Zohoor in view of Poon fails to teach or suggest this limitation, the proposed combination of art likewise fails to teach or suggest that "the microelectronic structure is defined at least in part by the active area, the second material, and the first and second isolation trenches" as recited in claim 42.

As the proposed combination of references fails to teach or suggest each and every limitation of claim 42, Omid-Zohoor in view of Poon and Park cannot render claim 42 obvious. Accordingly, claim 42 is allowable.

With respect to independent claim 43, the proposed combination of Omid-Zohoor and

Poon fails to teach or suggest "doping the first isolation trench and second isolation trench by implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide," "heat treating the oxide, first spacer, second spacer and conformal second material of the first isolation structure to fuse the oxide, first spacer, second spacer and conformal second material of the first isolation structure," "heat treating the oxide, first spacer, second spacer and conformal second material of the second isolation structure to fuse the oxide, first spacer, second spacer and conformal second material of the second isolation structure" or "removing the first material and portions of the oxide underlying the first material such that the second material fills each isolation trench, extends horizontally away from each isolation trench upon remaining portions of the oxide and sidewalls of the conformal second material originate on an upper surface of the semiconductor substrate and extend toward the upper surface contour of the second material, the sidewalls are oriented substantially orthogonal to the upper surface contour of the second material" as recited in claim 43. The Examiner acknowledges that Omid-Zohoor fails to teach or suggest implantation of ions. (Office Action sent August 26, 2009 at p. 7). Park also fails to teach or suggest ion implantation. Poon fails to teach or suggest that ions are implanted "in a direction substantially orthogonal to a plane of the oxide." Poon, col. 2, lines 59-64.

Omid-Zohoor teaches removing portions of the overfilled oxide 376 and silicon nitride layer 344 while the pad oxide layer 340 under the silicon nitride layer 344 remains. (Omid-Zohoor, col. 4, lines 60-62; FIG. 3N). The next step removes the pad oxide 340 resulting in slight oxide humps above the trenches. (*Id.*, col. 5, lines 5-10; FIG. 3O). Thus, the resulting overfilled oxide 376 does not "fill each said isolation trench, extends horizontally away from each said isolation trench upon remaining portions of the oxide and sidewalls of the conformal second material originate on an upper surface of the semiconductor substrate and extend toward the upper surface contour of the second material, the sidewalls are oriented substantially orthogonal to the upper surface contour of the second material" as recited in claim 43 because in Omid-Zohoor, the pad oxide 340 and horizontal portions of the overfilled oxide 376 are removed and the overfilled oxide 376 lacks any surface which is substantially orthogonal to the sidewalls of the overfilled oxide 376.

Poon and Park fail to cure the deficiencies of Omid-Zohoor. Instead, Poon and Park teach that trench plug (24a) 34 has substantially vertical sidewalls and does not extends horizontally away from the isolation trench. (Poon, FIG. 6; Park FIGs. 7 and 8). As the proposed combination of references fails to teach or suggest each and every limitation of claim 43, Omid-Zohoor in view of Poon and Park cannot render claim 43 obvious. Accordingly, claim 43 is allowable.

Obviousness Rejection Based on U.S. Patent No. 6,097,072 to Omid-Zohoor and U.S. Patent No. 5,387,540 to Poon et al. and Further in View of U.S. Patent No. 6,069,083 to Miyashita et al.

Claims 9 and 10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Omid-Zohoor (U.S. Patent No. 6,097,072) and Poon et al. (U.S. Patent No. 5,387,540) as applied to claims 7 and 11 above and further in view of Miyashita et al. (U.S. Patent No. 6,069,083). Applicants respectfully traverse this rejection, as hereinafter set forth.

The Court of Appeals for the Federal Circuit has stated that "dependent claims are nonobvious under section 103 if the independent claims from which they depend are nonobvious." In re Fine, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988). See also MPEP § 2143.03. Having failed to teach or suggest each and every limitation of the current application, the prior art referenced as rendering dependent claims 9 and 10 obvious, cannot serve as a basis for rejection.

Obviousness Rejection Based on U.S. Patent No. 6,097,072 to Omid-Zohoor and U.S. Patent No. 5,387,540 to Poon et al. and Further in View of U.S. Patent No. 4,963,502 to Teng et al.

Claims 36, 37, 39 and 40 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Omid-Zohoor (U.S. Patent No. 6,097,072) and Poon et al. (U.S. Patent No. 5,387,540) as applied to claims 35 and 38 above and further in view of Teng et al. (U.S. Patent No. 4,963,502). Applicants respectfully traverse this rejection, as hereinafter set forth.

The discussion of Omid-Zohoor and Poon above is incorporated herein. Teng et al. is cited for teaching providing a p+ semiconductor substrate and implanting dopants in trenches to produce N-wells. (Teng, col. 6, lines 55-59; Office Action sent August 26, 2009, page 39). Teng fails to cure the deficiencies of Omid-Zohoor and Poon.

The Court of Appeals for the Federal Circuit has stated that "dependent claims are nonobvious under section 103 if the independent claims from which they depend are nonobvious." In re Fine, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988). See also MPEP § 2143.03. Having failed to teach or suggest each and every limitation of the current application, the prior art referenced as rendering dependent claims 36, 37, 39 and 40 obvious, cannot serve as a basis for rejection.

ENTRY OF AMENDMENTS

The amendments to claims 1, 5-14, 17-19, 21, 24-26, 31-36, 38, 39, 42 and 43 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application.

CONCLUSION

Claims 1, 3-22, 24-27, 31-40, 42 and 42, are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,

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Date: November 23, 2009
KAH/kso/tlp
Document in ProLaw